AMENDMENTS

A Version With Markings to Show Changes Made follows Applicant's Remarks.

In the Claims:

Please cancel Claims 13, 20, 24-26, 31, 32, 37, and 38, without prejudice, as being directed to a non-elected claim group. Please amend Claims 1, 17, 22, 23, 28, 29, 33, 34, 39, 43, and 49 as follows.

1. (Thrice Amended) An in vitro method of transdifferentiating an epidermal basal cell into a cell having one or more morphological, physiological and/or immunological feature(s) of a neuronal cell, comprising:

(a) culturing a proliferating epidermal basal cell population comprising one or more epidermal basal cell(s), said cell(s) derived from the skin of a mammalian subject;

(b) exposing the cell(s) to an amount of an antagonist of bone morphogenetic protein (BMP) effective to antagonize endogenous BMP signal transduction activity;

(c) growing the cell(s) in the presence of at least one antisense oligonucleotide comprising a segment of a human MSX1 gene and/or a segment of a human HES1 gene, or homologous non-human counterpart of either of these, in an amount effective to suppress the expression of functional gene product of MSX1 and/or HES1, whereby the cell is transdifferentiated into a cell having one or more morphological, physiological and/or immunological feature(s) of a neuronal cell; and

(d) growing the transdifferentiated cell in a medium comprising a retinoid compound and a signal molecule selected from the group consisting of brain-derived neurotrophic factor

(BDNF), platelet derived growth factor (PDGF), nerve growth factor (NGF), sonic hedgehog, sonic hedgehog aminoterminal peptide, neurotrophin (NT)-3, and neurotrophin (NT)-4; and

wherein the physiological and/or immunological feature comprises expression of a neuronal cell marker selected from the group consisting of neurofilament M, neural-specific β-tubulin, neural-specific enolase, and microtubule associated protein 2, or a combination of any of these; and wherein the morphological feature comprises one or more morphological neurite-like process(es) at least about 50 micrometers in length.

2. (Reiterated) The method of Claim 1, wherein the subject is a human.

3. (Reiterated) The method of Claim 1, wherein the epidermal basal cell(s) is derived from a skin biopsy.

4. (Reiterated) The method of Claim 1, wherein culturing the proliferating epidermal basal cell population further comprises separating keratinized epidermal cells from the epidermal basal cells in a calcium-free medium.

5. (Reiterated) The method of Claim 1, wherein the amount of the antagonist of bone morphogenetic protein is about 10^{-6} to 10^{-4} M.

6. (Reiterated) The method of Claim 5, wherein the amount of the antagonist of bone morphogenetic protein is about 5×10^{-6} to 5×10^{-5} M.

7. (Reiterated) The method of Claim 1, wherein the antagonist of bone

morphogenetic protein (BMP) is fetuin, noggin, chordin, gremlin, or follistatin.

8. (Reiterated) The method of Claim 7, wherein the fetuin is mammalian or avian fetuin.

9. (Reiterated) The method of Claim 8, wherein the mammalian fetuin is human, bovine, porcine, ovine, or equine fetuin.

10. (Reiterated) The method of Claim 1, wherein the antisense oligonucleotide(s) is modified with one or more thio groups.

11. (Reiterated) The method of Claim 1, wherein the amount of the antisense oligonucleotide is about 5 x 10^{-6} M to about 10^{-5} M.

13. (Canceled)

15. (Reiterated) The method of Claim 1, wherein the retinoid compound is all-trans retinoic acid or Vitamin A.

17. (Amended) A transdifferentiated cell of epidermal origin having one or more morphological, physiological and/or immunological feature(s) of a neuronal cell produced by the method of Claim 1.

19. (Reiterated) The transdifferentiated cell of Claim 17, wherein the cell further exhibits a lack of mitotic activity under cell culture conditions which induce differentiation in neural progenitor cells.

20. (Canceled)

22. (Amended) The transdifferentiated cell of Claim 17, wherein the cell is a GABAergic cell.

23. (Amended) The transdifferentiated cell of Claim 17, wherein the cell is a dopaminergic cell.

24. (Canceled)

25. (Canceled)

26. (Canceled)

27. (Reiterated) The transdifferentiated cell of Claim 17, wherein the cell is of human origin.

28. (Amended) A cell culture derived from the transdifferentiated cell of Claim 17, comprising a plurality of cells that express one or more morphological, physiological and/or

immunological feature(s) of a neuronal cell.

29. (Twice Amended) A transdifferentiated cell of epidermal origin and cultured in vitro, comprising a cell of epidermal basal cell origin, said transdifferentiated cell displaying one or more morphological, physiological and/or immunological feature(s) of a neuronal cell, wherein the physiological and/or immunological feature comprises expression of a marker selected from the group consisting of neurofilament M, neural-specific β-tubulin, neural-specific enolase, and microtubule associated protein 2, or a combination of any of these.

30. (Reiterated) The transdifferentiated cell of Claim 29, wherein the cell further displays the physiological feature of a lack of mitotic activity under cell culture conditions which induce differentiation in neural progenitor cells.

31. (Canceled)

32. (Canceled)

33. (Amended) The transdifferentiated cell of Claim 29, wherein the cell is a GABAergic cell.

34. (Amended) The transdifferentiated cell of Claim 29, wherein the cell is a dopaminergic cell.

35. (Reiterated) The transdifferentiated cell of Claim 29, wherein the morphological

feature comprises one or more neurite-like process(es) at least about 50 micrometers in length.

36. (Reiterated) The transdifferentiated cell of Claim 29, wherein the cell is of human origin.

37. (Canceled)

38. (Canceled)

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39. (Amended) A cell culture derived from the transdifferentiated cell of Claim 29, comprising a plurality of cells that express one or more morphological, physiological and/or immunological feature(s) of a neuronal cell.

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43. (Twice Amended) A kit for transdifferentiating, in vitro, an epidermal basal cell into a cell having one or more morphological, physiological and/or immunological feature(s) of a neuronal cell, comprising:

(A) an antagonist of bone morphogenetic protein (BMP);

(B) at least one antisense oligonucleotide comprising a segment of a human MSX1 gene, a segment of a human HES1 gene, or a non-human homologous counterpart of either of these; and

(C) a retinoid compound and a signal molecule selected from the group consisting of brain-derived neurotrophic factor (BDNF), platelet-derived growth factor (PDGF), nerve growth factor (NGF), neurotrophin (NT)-3, neurotrophin (NT)-4, sonic hedgehog, and sonic hedgehog aminoterminal peptide.

44. (Reiterated) The kit of Claim 43, further comprising instructions for using (A), (B), and (C) in transdifferentiating a subject's epidermal basal cell(s).

45. (Reiterated) The kit of Claim 43, wherein the antagonist of bone morphogenetic protein (BMP) is fetuin, noggin, chordin, gremlin, or follistatin.

47. (Reiterated) The kit of Claim 43, wherein the retinoid compound is all-trans retinoic acid or Vitamin A.

49. (Amended) An in vitro method of transdifferentiating an epidermal basal cell into a cell having one or more morphological, physiological and/or immunological feature(s) of a neuronal cell, comprising:

(a) culturing a proliferating epidermal basal cell population comprising one or more epidermal basal cell(s), said cell(s) derived from the skin of a mammalian subject;

(b) exposing the cell(s) to an amount of an antagonist of bone morphogenetic protein (BMP) effective to antagonize endogenous BMP signal transduction activity;

(c) growing the cell(s) in the presence of at least one antisense oligonucleotide comprising a segment of a human MSX1 gene and/or a segment of a human HES1 gene, or homologous non-human counterpart of either of these, in an amount effective to suppress the expression of functional gene product of MSX1 and/or HES1, whereby the cell is transdifferentiated into a cell having one or more morphological, physiological and/or immunological feature(s) of a neuronal; and

(d) growing the transdifferentiated cell in a medium comprising a retinoid compound and a signal molecule selected from the group consisting of brain-derived neurotrophic factor (BDNF), platelet-derived growth factor (PDGF), nerve growth factor (NGF), neurotrophin (NT)-3,

neurotrophin (NT)-4;

wherein the physiological and/or immunological feature comprises expression of a neuronal cell marker selected from the group consisting of neurofilament M, neural-specific β-tubulin, neural-specific enolase, and microtubule associated protein 2, or a combination of any of these; and

wherein the morphological feature comprises one or more morphological neurite-like process(es) at least about 50 micrometers in length.

50. (Reiterated) The method of Claim 49, wherein the subject is a human.

51. (Reiterated) The method of Claim 49, wherein the epidermal basal cell(s) is derived from a skin biopsy.

52. (Reiterated) The method of Claim 49, wherein culturing the proliferating epidermal basal cell population further comprises separating keratinized epidermal cells from the epidermal basal cells in a calcium-free medium.

53. (Reiterated) The method of Claim 49, wherein the amount of the antagonist of bone morphogenetic protein is about 10^{-6} to 10^{-4} M.

54. (Reiterated) The method of Claim 53, wherein the amount of the antagonist of bone morphogenetic protein is about 5×10^{-6} to 5×10^{-5} M.

55. (Reiterated) The method of Claim 49, wherein the antagonist of bone morphogenetic protein (BMP) is fetuin, noggin, chordin, gremlin, or follistatin.

56. (Reiterated) The method of Claim 55, wherein the fetuin is mammalian or avian fetuin.

57. (Reiterated) The method of Claim 56, wherein the mammalian fetuin is human, bovine, porcine, ovine, or equine fetuin.

58. (Reiterated) The method of Claim 49, wherein the antisense oligonucleotide(s) is modified with one or more thio groups.

59. (Reiterated) The method of Claim 49, wherein the amount of the antisense oligonucleotide is about 5 x 10^{-6} M to about 10^{-5} M.

60. (Reiterated) The method of Claim 49, wherein the retinoid compound is all-trans retinoic acid or Vitamin A.

61. (Reiterated) A transdifferentiated cell of epidermal origin having one or more morphological, physiological and/or immunological feature(s) of a neuronal cell produced by the method of Claim 49, wherein the physiological and/or immunological feature comprises expression of a marker selected from the group consisting of neurofilament M, neural-specific β-tubulin, neural-specific enolase, and microtubule associated protein 2, or a combination of any of these; and wherein the morphological feature comprises one or more morphological neurite-like process(es) at least about 50 micrometers in length.

62. (Reiterated) The transdifferentiated cell of Claim 61, wherein the cell further exhibits a lack of mitotic activity under cell culture conditions which induce differentiation in neural progenitor cells.

63. (Reiterated) The transdifferentiated cell of Claim 61, wherein the cell is a GABAergic cell.

64. (Reiterated) The transdifferentiated cell of Claim 61, wherein the cell is a dopaminergic cell.

65. (Reiterated) The transdifferentiated cell of Claim 61, wherein the cell is of human origin.

66. (Reiterated) A cell culture derived from the transdifferentiated cell of Claim 61, comprising a plurality of cells that express one or more morphological, physiological and/or immunological feature(s) of a neuronal cell.